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Soft Cores in Late-Type Dwarf and LSB Galaxies from Hα Observations

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Abstract. We present high spatial resolution Hα rotation curves of late-type dwarf and LSB galaxies. From our analysis we find good agreement between our Hα data and the HI observations taken from the literature, concluding that the HI rotation curves for these galaxies suffer very little from beam smearing. A preliminary analysis of our data rules out the CDM model in the inner regions of these galaxies.

1. Introduction

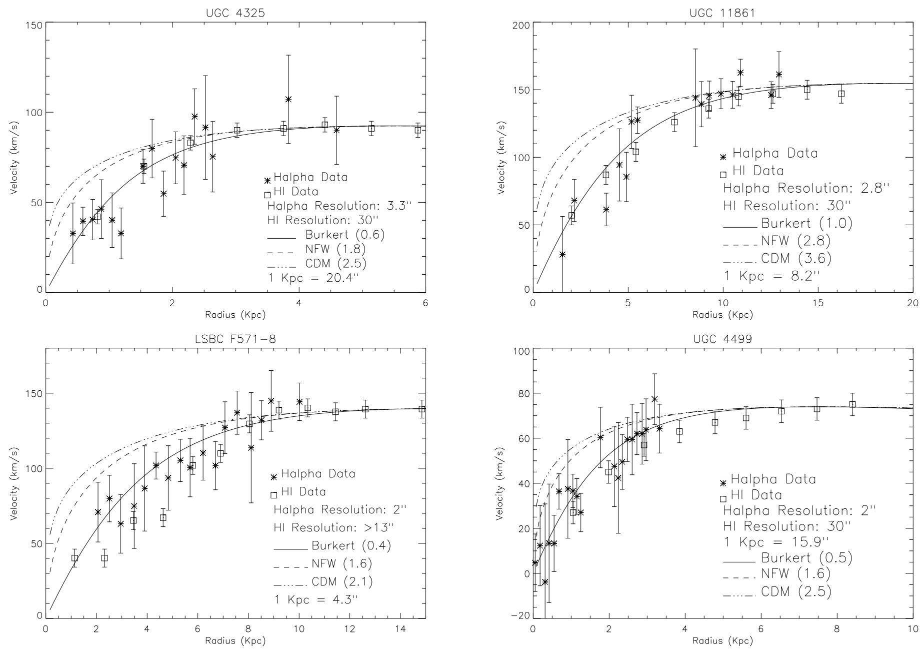
The current scenario for structure formation in the universe is based on the inflationary Cold Dark Matter (CDM) theory. High-resolution N-body simulations predict, for the virialized haloes, density profiles with central cusps with $\rho \propto r^{-1.5}$ when r $\rightarrow$ 0 (Moore et al. 1999), even more cuspy than previous simulation results (Navarro, Frenk, and White 1997, hereafter NFW). These profiles are in conflict with the observations: rotation curves of late-type dwarf and LSB galaxies (DM dominated galaxies) seem to rule out singular halo profiles and are in good agreement with density profiles characterized by soft cores, central regions with constant density (de Blok & McGaugh 1997). On the other hand, van den Bosch & Swaters (2001) claim that these HI rotation curves are affected by beam smearing, concluding that the observed rotation curves are consistent with NFW model. A good spatial resolution (easily achievable with Hα observations) is necessary to explore the galaxy inner regions and rule out beam smearing. We show some preliminary results of our Hα observations for some dwarf and LSB galaxies. This work assumes H_o=75 km s^{-1} Mpc^{-1}.

2. Observations

Observations of late-type dwarf and LSB galaxies were carried out at the 3.6 m Telescopio Nazionale Galileo (TNG) both in photometric and spectroscopic mode using the instrument Dolores (scale = 0.275 Åpxl^{-1}, dispersion = 0.8 Åpxl^{-1}, $\lambda \in (6200, 7800)$ Å). In Table 1 we list the properties of some of the observed galaxies.

Table 1. Properties of the observed galaxies

Name	Type	D (Mpc)	M (mag)	μ_o (mag arcsec^{-1})	h (kpc)
UGC 4325	SA(s)m	10.1	-18.1(R)	21.6(R)	1.7(R)
UGC 4499	SABdm	13.0	-17.8(R)	21.5(R)	2.0(R)
UGC 11861	SABdm	25.1	-20.8(R)	21.4(R)	6.1(R)
LSBC F571-8	Sc	48.0	-17.6(B)	23.9(B)	5.2(B)



Our Hα data (stars in the figures) are plotted together with HI data (from literature, empty squares). As one can see, the HI data suffer of very little beam smearing. The solid lines are the best fits obtained by using the Burkert profile; the dashed lines are NFW profiles and the dotted-dashed lines are Moore profiles (CDM model). The numbers in parenthesis represent the normalized χ^2 for each fit. For each galaxy is stated the spatial resolution for both the Hα and the HI data. For all the four galaxies, the Burkert profile is the best fit, while the Moore profile does not match data. New observations with high resolution new technology grating (VPHG, Conconi et al. 2001) are being planned.

3. Conclusions

Our preliminary analysis of Hα observations seems to rule out the CDM model in the inner regions of LSB and dwarf galaxies, showing evidence of soft cores.

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